Sustainability assessment of water supply in Copenhagen

Alternatives fulfilling the EU-Water Framework Directive

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Water utilities seek to satisfy the increasing demand for both potable and non-potable water and at the same time improving the environmental performance of the water system. The EU-Water Framework Directive states that the current drinking water production for Copenhagen based on abstracted groundwater is too high and calls for actions to protect and enhance the status of aquatic ecosystems. This has emphasized the need for development of a methodology for sustainability assessment of alternative sources or compensating actions capable of supplementing the current water production. We investigated 4 alternatives - Rainwater harvesting, Compensating actions, New well sites and Desalination - all tailored for solving the water shortages implied by the Directive. We conducted a Life cycle assessment (LCA) of the alternatives and the base scenario of today to find their environmental performance. The stages included in the LCA are: Water withdrawal, Water treatment, Distribution including effects of water quality in the households (hardness) (Godskesen et al., *accepted*), Electricity for transport and treatment of sewage. We found that the alternative with the lowest impact was rainwater harvesting followed by the base scenario. Desalination had a relatively high impact but was found lower compared to others (Lundie et al., 2004; Lyons et al., 2009) due to the effects in the households of the soft water compared to drinking water coming from groundwater.

We compared production of 1 m^3 of drinking water in Copenhagen as it is produced today with consumers buying bottled water (Jungbluth, 2006). The comparison showed that the impact increases approximately 900 times, thus bottled water is not environmentally rational compared to water supply as of today.

At the time of writing the LCA does not reflect the impact on the freshwater resources and a method will be developed to quantify the effect of water use in relation to water availability. The latest results of this water use impact will be presented at the conference.

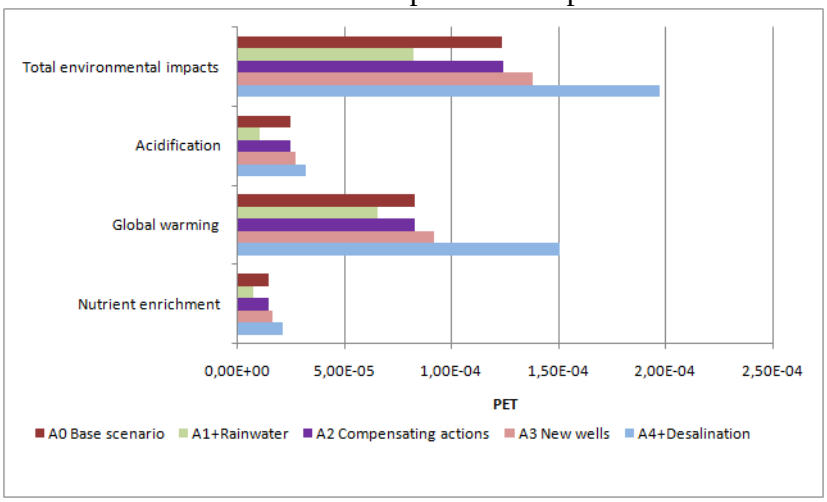

Figure 1. Results of the Life cycle assessment of 4 alternatives for drinking water supply in Copenhagen. A1 and A4 includes the effects of the water quality in the households due to softer water.

References

Godskesen, B., Hauschild, M., Rygaard, M., Zambrano, K., Albrechtsen, H.-J. (*accepted*). Life cycle assessment of central softening of very hard drinking water. J. Env. Management. *Accepted for publication December '11*.

Jungbluth, N. (2006). Comparison of the environmental impact of drinking water vs. bottled mineral water, Manuscript for the SGWA information bulletin and GWA (gas water sewage).

Lundie, S., Peters, G.M., Beavis, P.C. (2004). Life Cycle Assessment for Sustainable Metropolitan Water Systems Planning, Environ. Sci. Technol. 38, 3465-3473.

Lyons, E., Zhang, P., Benn, T., Sharif, F., Costanza, M., Li, K., Crittenden, J., Chen, Y.S. (2009). Life cycle assessment of three water supply systems: Importation, reclamation and desalination, Water Sci. Technol. Water Supply 9, 439-448.